Savannah River Site
Solid Waste Management Department
Consolidated Incinerator Facility
Operator Training Program

WASTE SYSTEMS
SPARE TANK SYSTEM (U)

Study Guide

ZIOITX01.01

Revision 3

_____
Training Manager / Date

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Engineering Manager / Date

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Facility Manager / Date

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REVISION LOG

REV.	AFFECTED SECTION(S)	SUMMARY OF CHANGE
00	All	New Issue.

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REFERENCES

1. WSRC- SA-17, Safety Analysis Report, 200-H Area, Consolidated Incineration Facility, DOE Approval Copy, December 1994

2. WSRC Solid Waste Training, Waste System, System Design Description ZIOISX01, Rev. 0

3. WSRC Consolidated Incineration Facility Project S2787, Tank Farm Functional Description J-SD-H-00001, September 1993, Rev. A

4. 261-SOP-WTE-02 R, Spare Tank Operations, February 14, 1996, Rev. 3

5. WSRC Consolidated Incineration Facility Setpoint Index, J-JX-H-0020 Parts I and II, Rev. 3

6. SE5-2-2006176 CIF Tank Farm Logic Diagram Sheet 2 Instruments, Rev. 3

7. SE5-2-2006177 CIF Tank Farm Logic Diagram Sheet 3 Instruments, Rev. 3

8. SE5-2-2006178 CIF Tank Farm Logic Diagram Sheet 4 Instruments, Rev. 3

9. SE5-2-2006179 CIF Tank Farm Logic Diagram Sheet 5 Instruments, Rev. 2

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11. SE5-2-2006266 CIF Tank Farm Logic Diagram Sheet 20 Instruments, Rev. 3

12. W2017838, CIF Tank Farm Logic Diagram Sheet 25 Instruments, Rev. 3

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15. W830309, Savannah River Site Building 262-H Area 200-H Spare Tank Process Serv PPG & Inst Diag Process and Instruments (U), Rev. 67

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LEARNING OBJECTIVES

TERMINAL OBJECTIVE

1.00 Without references, **EXPLAIN** the significance of the Spare Tank System to Consolidated Incinerator Facility operations, including its importance to safety, and the impact on operations of a failure of the system.

2.00 Using system diagrams, **EVALUATE** potential problems which could interfere with normal Spare Tank System flowpaths to determine their significance on overall system operation and the corrective actions needed to return the system to normal.

3.00 Given values of Spare Tank System operation parameters, **EVALUATE** potential problems that could effect the normal functioning of the system or its components to determine the significance of the existing condition and the actions required to return the system to normal operation.

4.00 Given necessary procedures or other technical documents and system conditions, **DETERMINE** the operator actions required for normal and offnormal operation of the Spare Tank System including problem recognition and resolution.

ENABLING LEARNING OBJECTIVES

1.01 **STATE** the purpose of the Spare Tank System.

1.02 Briefly **DESCRIBE** how the Spare Tank System accomplishes its intended purpose.

2.01 **DESCRIBE** the Spare Tank System arrangement to include a drawing showing the following system components and interfaces with other systems:

a. Spare Tank
b. Spare Tank Transfer Pump
c. Flow Transmitter
d. Rupture Disk
e. Flame Arrester
f. Conservation Vent

2.02 Given a description of the Spare Tank System equipment status, **IDENTIFY** conditions which interfere with normal system flowpaths.

2.03 Given a description of abnormal equipment status for the Spare Tank System, **EXPLAIN** the significance of the condition on system operation.

3.01 **DESCRIBE** the following major components of the Spare Tank System including their functions and principles of operation:

a. Spare Tank
b. Spare Tank Loop Seal
c. Spare Tank Transfer Pump
d. Rupture Disk
e. Conservation Vent

3.02 **DESCRIBE** the following Spare Tank System instrumentation including indicator location (local or Control Room), sensing points, and associated instrument controls:

a. Tank Level
b. Tank Pressure
c. Tank Temperature
d. Flow Measurement

3.03 **INTERPRET** the following Spare Tank System alarms, including the conditions causing alarm actuation and the basis for the alarms:

a. HIGH Corrosion
b. HIGH Level
c. HIGH-HIGH Level
d. HIGH-HIGH-HIGH Level
e. LOW Level
f. LOW-LOW Level
g. LOW-LOW-LOW Level
h. HIGH N2 Pressure
i. LOW N2 Pressure
j. HIGH-HIGH Temperature
k. LOW-LOW Temperature

3.04 **EXPLAIN** how the following Spare Tank System equipment is controlled in all operating modes or conditions to include control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation:

a. Spare Tank Transfer Pump

b. Tank Agitator

3.05 **DESCRIBE** the interlocks associated with the following Spare Tank System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary:

a. Spare Tank Transfer Pump

b. Isolation Valves

4.01 Given applicable procedures and plant conditions, **DETERMINE** the actions necessary to perform the following Spare Tank System operations:

a. Startup

b. Manual Operation of Equipment

c. Shutdown

4.02 **DETERMINE** the effects on the Spare Tank System and the integrated plant response when given any of the following:

a. Indications/alarms

b. Malfunctions/failure of components

SYSTEM OVERVIEW

Safety

All personnel should be aware of the importance of safety. To prevent any mishaps from occurring, personnel should follow the guidelines set forth in WSRC 4Q, Industrial Hygiene Manual and WSRC 8Q, Employee Safety Manual.

The hazards associated with the Spare Tank System will mostly be the hazards associated with the Tank Farm in general. Operators should be alert at all times and be aware of the possibility for:

- Electric shock
- Inadequate lighting resulting in various injuries (e.g., tripping)
- Various injuries (e.g., hand injuries) resulting from contact with moving components
- Objects falling from tank tops
- Overpressurization of carbon canisters
- Vehicular traffic
- Heat stress (Summer months)
- Exposure to liquid release; fuel oil, organic waste, aqueous waste, etc.
- Exposure to toxic chemicals, carcinogens, frost bite by nitrogen release
- Asphyxiation from oxygen depletion by nitrogen release
- Fire and/or explosions

All personnel should remember the possibility for natural phenomena hazards.

Introduction

The Tank Farm is the point of entry for all liquid waste arriving from outside of the facility. In addition to the Spare Tank System, the following systems including are all associated with the Tank Farm:

- Radioactive Organic Waste System
- Blended Waste System
- Aqueous Waste System
- Waste Vent System
- Waste Drains System

Each of these systems will be discussed in detail in their respective modules.

Equipment in the Tank Farm consists of storage tanks with agitators, pumps, piping around the tanks and pumps, a clean truck unloading station, a regulated truck unloading station,

containment work access platforms, and a fire suppression (foam) system.

This module will discuss the Spare Tank System and also address those items/subsystems which are common to all of the waste tanks located at the Tank Farm. These topics will include the Loop Seal System associated with the waste tanks, the Pump Seal System associated with selected centrifugal transfer pumps, and the agitator and recirculation lines which are used for mixing.

SYSTEM PURPOSE

ELO 1.01	**STATE the purpose of the Spare Tank System.**
ELO 1.02	**Briefly DESCRIBE how the Spare Tank System accomplishes its intended purpose.**

The Tank Farm functions as a receiving and storage area for liquid Non-Radioactive Hazardous Waste and Low Level Radioactive Waste. In addition, non-contaminated process materials (such as fuel oil, nitrogen, and cement), which are used to facilitate the operation of the CIF, are received and stored at the Tank Farm.

The purpose of the Spare Tank system is to provide excess storage capacity in the event that an unplanned condition occurs. These conditions might be a tank leak, or any other occurrence that requires additional liquid storage space. At all times, the available capacity of the Spare Tank must at least be equal to the largest inventory of liquid waste in the other tanks. The Spare Tank can also be used as a standby mixing tank. The Spare Tank has physical feed connections from the Blended Waste Tanks, Aqueous Waste Tank, Radioactive Organic Waste stream, Regulated Sumps and the Regulated Rad Oils/Solvents Unloading Pump. The Spare Tank System is capable of feeding fluid to the Sample Station, Aqueous Waste System and the Blended Waste System (Tanks 1 and 2) via the Spare Tank Transfer Pump. With these connections, various flow controllers and various equipment (i.e. agitator), the Spare Tank is able to accomplish its intended purpose.

DESCRIPTION AND FLOWPATH

Introduction

The Tank Farm is an opened structure located west of Building 261-H. Five liquid storage tanks are located within the Tank Farm containment walls for spill containment and collection. A regulated area (for radioactive materials and hazardous chemicals) and a clean area (for non-radioactive and non-hazardous chemicals) are provided for unloading of liquid waste and process materials necessary at the CIF.

System Description

The Spare Tank System is shown in Figure 1, Spare Tank System Simplified Drawing. The spare storage tank is a nominal 6500-gallon, carbon steel vessel, which is located in the west end of the regulated area. The spare storage tank functions as a reserve storage for liquid wastes when wastes cannot be directed to either the blend tanks or the aqueous waste tanks.

ELO 2.01	**DESCRIBE the Spare Tank System arrangement to include a drawing showing the following system components and interfaces with other systems:** **a. Spare Tank** **b. Spare Tank Transfer Pump** **c. Flow Transmitter** **d. Rupture Disk** **e. Flame Arrester** **f. Conservation Vent**

Spare Tank Flowpaths

Liquid waste can be directed to the Spare Tank from any of the following:

- Blend Tank #1
- Blend Tank #2
- Aqueous Waste Tank
- Rad Oils/Solvents Unloading Pump
- Regulated Sump Pump
- Discharge of the Automatic Sampler

While it is possible to supply the Spare Tank from six different sources, the tank can be supplied by only one source at a time. With the exception of the sump pump and the rad/oils solvents unloading pump, the transfer pump used to charge the Spare Tank will normally be started by the operator at the DCS. It is the operator's responsibility to select a waste supply and to follow procedures accordingly. The operator then starts the selected transfer pump.

One minute after the pump is started, the pneumatically operated (automatic) valve in the related supply line to the Spare Tank is opened. The other automatic isolation valves in the supply lines to the Spare Tank and the other tanks are kept closed by the DCS.

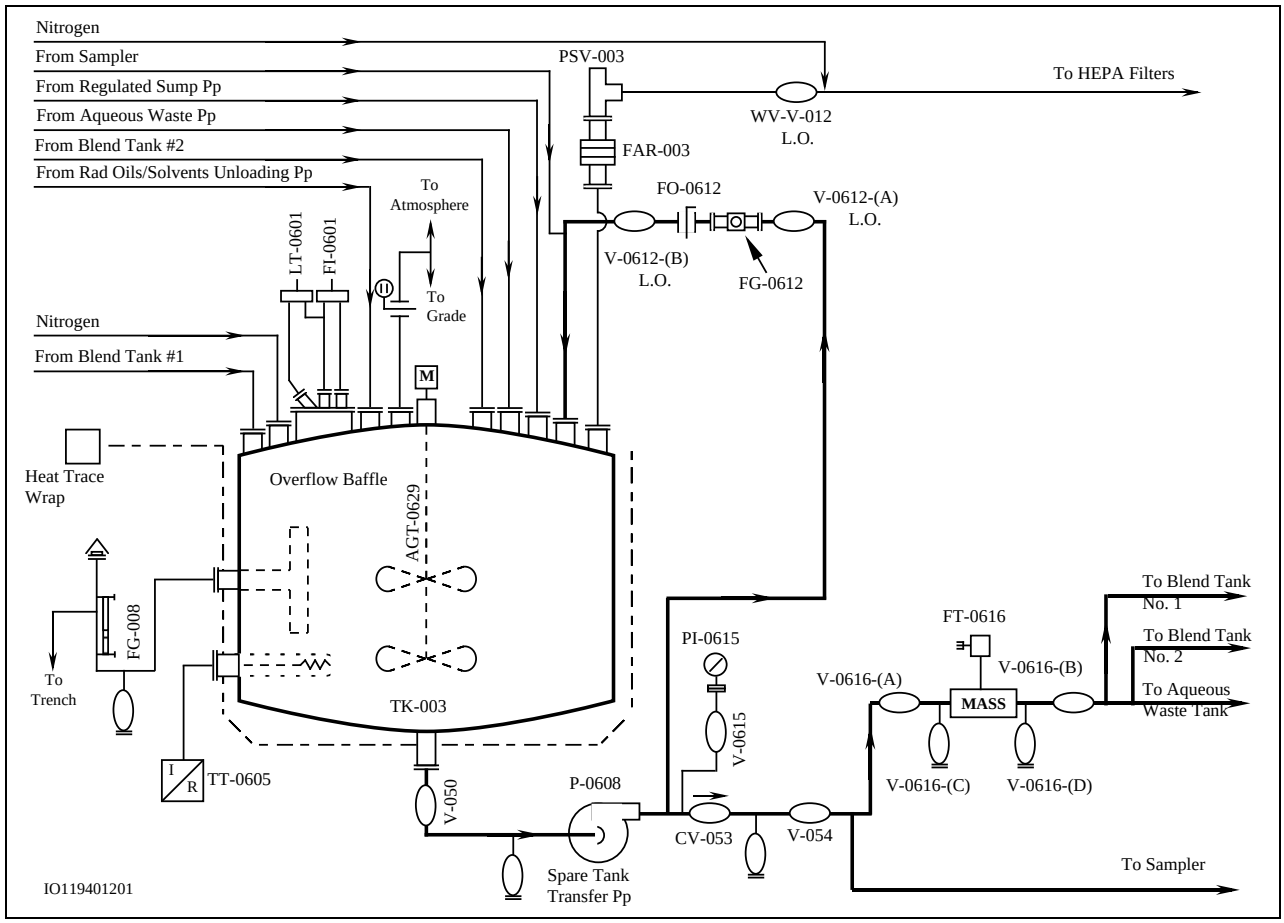


Figure 1 - Spare Tank System Simplified Drawing

All waste enters the tank from the top. Liquid from the Spare Tank may be pumped via the Spare Tank Transfer Pump to Blend Tank #1 (FV-0308), Blend Tank #2 (FV-0411), or the Aqueous Waste Tank (FV-0528). A 1-inch branch line provides flow from the Spare Tank to the Automatic Sampler. Another 1-inch line provides a recirculation path back to the Spare Tank to prevent running the pump at shutoff head.

Normally, the contents of the Spare Tank are transferred to one of the Blend Tanks. If sample

analysis indicates that the heating value of the contents of the Spare Tank is less than 2,200 Btu/lb and the material is compatible with water, then the contents may be transferred to the Aqueous Waste Tank.

Summary

- Liquid waste can be directed to the Spare Tank from any of the following:
  - Blend Tank #1
  - Blend Tank #2
  - Aqueous Waste Tank
  - Rad Oils/Solvents Unloading Pump
  - Regulated Sump Pump
  - Discharge of the Automatic Sampler

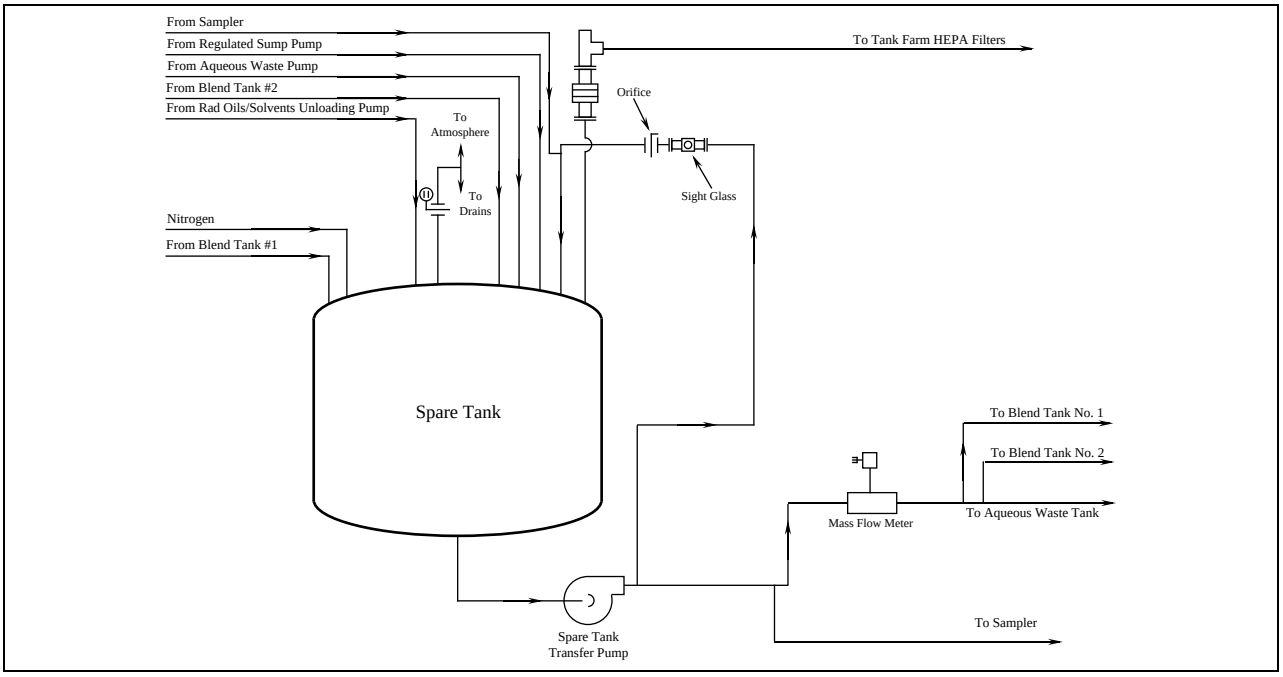


Figure 2 - Oneline Diagram of the Spare Tank System

- Only one source (of six) at a time can supply the Spare Tank.
- The transfer pump used to charge the Spare Tank will normally be started by the operator at the DCS.

- Liquid from the Spare Tank may be pumped to:
  - Blend Tank #1
  - Blend Tank #2
  - Aqueous Waste Tank
  - Automatic Sampler
- Recirculation:
  - to sampler back to the tank

MAJOR COMPONENTS

ELO 3.01	**DESCRIBE the following major components of the Spare Tank System including their functions and principles of operation:** **a. Spare Tank** **b. Spare Tank Loop Seal** **c. Spare Tank Transfer Pump** **d. Rupture Disk** **e. Conservation Vent**

Spare Tank

The Spare Tank is a carbon steel vessel, 14 feet 6 inches high and 10 feet in diameter, with a maximum capacity of 6500 gallons. The tank is located at the west end of the regulated compartment of the diked area of the Tank Farm. The tank is equipped, internally, with four baffles. Each baffle is 10 feet 1 1/2 inches high by 10 inches wide by 3/8 inch thick and mounted inside the tank 90° apart. The tank is designed for 10 psig positive pressure plus static head and a 2.5 psig negative pressure at 200 °F.

The tank is electrically heat traced and insulated with 2-inch polyisocyanurate insulation. The heat trace maintains a temperature of 50 °F for freeze protection. Tank temperature is controlled by the DCS. Provisions have been made for the installation of a electric emersion heater if required. Tank legs are protected with 3-hour National Fire Protection Association (NFPA) fireproofing. The Spare Tank is equipped with a top-mounted 3-blade agitator driven by a 1.0 hp explosion proof electric motor powered from MCC 3, Cubicle #1J.

Nitrogen is supplied to the tank (refer back to Figure 1, Spare Tank System Simplified Drawing) for purging the tank prior to charging any waste to the tank and for maintaining an inert blanket above the liquid level after the waste has been charged.

Figure 3, CIF Tank Farm Layout shows the location of the Spare Tank in the Tank Farm, as well as other components associated with the CIF Tank Farm. The Spare Tank serves the purpose of a standby mixing tank and can be supplied as mentioned earlier with liquid waste from any one of six sources. Originally, the Spare Tank was to serve as the Radioactive Organic Waste Storage Tank at the CIF. It was later determined that this was not only unnecessary but undesirable, as the Organic Waste Storage Tank at the DWPF was more than adequate to serve that function. It is still possible, with the use of mechanical jumpers, to connect the ROW System to the Spare Tank, but it is unlikely that this would be done.

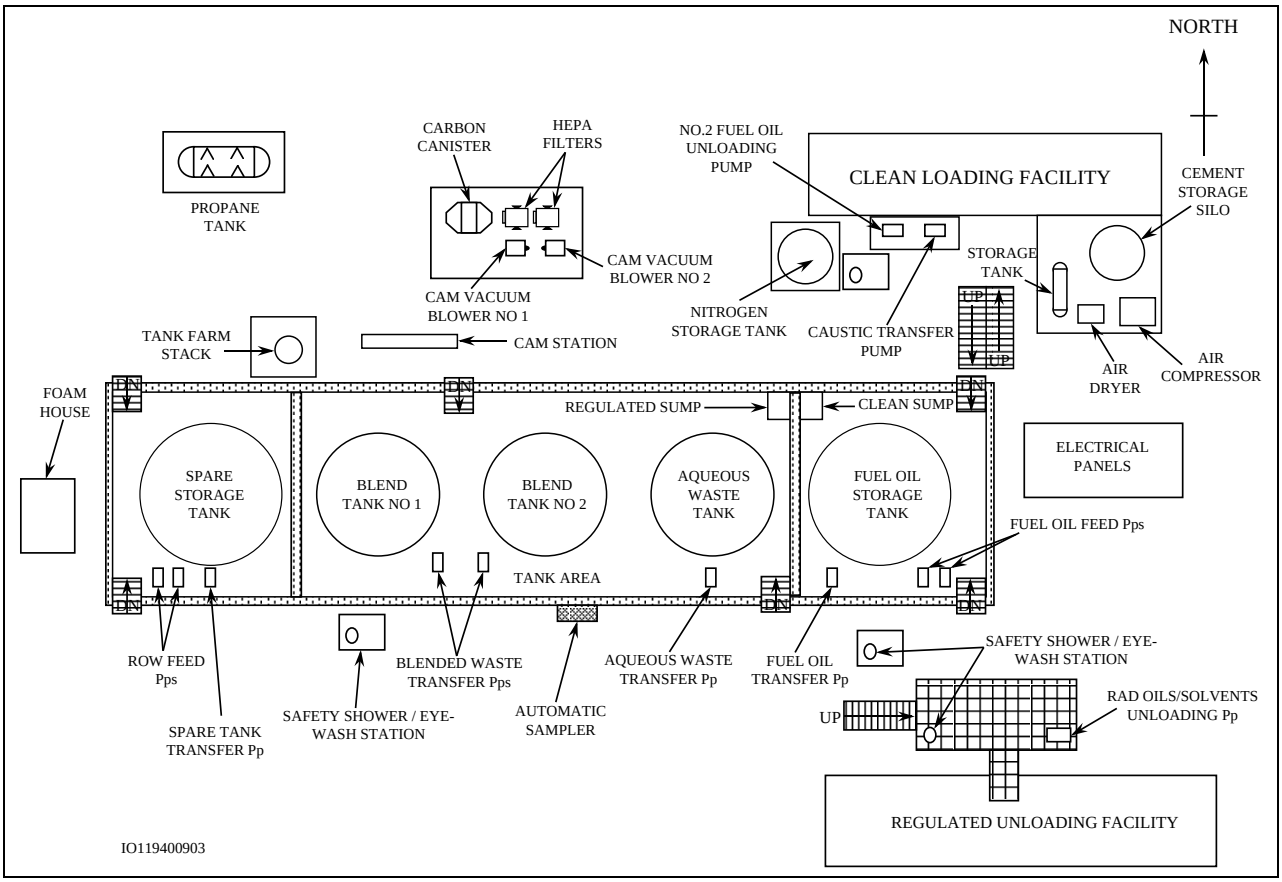


Figure 3 - CIF Tank Farm Layout

Waste Tank Loop Seal, Rupture Disk and Conservation Vent

Each of the waste tanks, including the Spare Tank, is equipped with a conservation vent, flame arrester, and a rupture disc (discussed in detail in the Waste Vent System Module) and a Loop Seal System (Figure 4, Waste Tank Loop Seal System).

The Waste Vent System is equipped with a flame arrester and conservation vent. These components are provided for the normal expulsion of nitrogen and hydrocarbon vapors during a tank filling mode and/or outbreathing due to an increase in temperature inside the tank. The conservation vent (PSV-003) will not open until the gas pressure in the tank is 8 INWC. The flame arrester (FAR-003) prevents the propagation of a flame from outside the stack back into the vent system.

The Loop Seal System works in conjunction with the rupture disc to provide over-pressure protection and vacuum protection for the waste tanks in the Tank Farm. The loop seal is designed to cause the rupture disk to break on positive pressure before it overflows and to collapse (purge seal fluid to tank) on partial vacuum before the rupture disk breaks. The loop seal will withstand 2.38 psig positive pressure before it overflows and will collapse at 2.38 psig negative pressure. The rupture disc is designed to break at 1.5 psig positive pressure and to withstand a minimum pressure of 2.50 psig negative pressure.

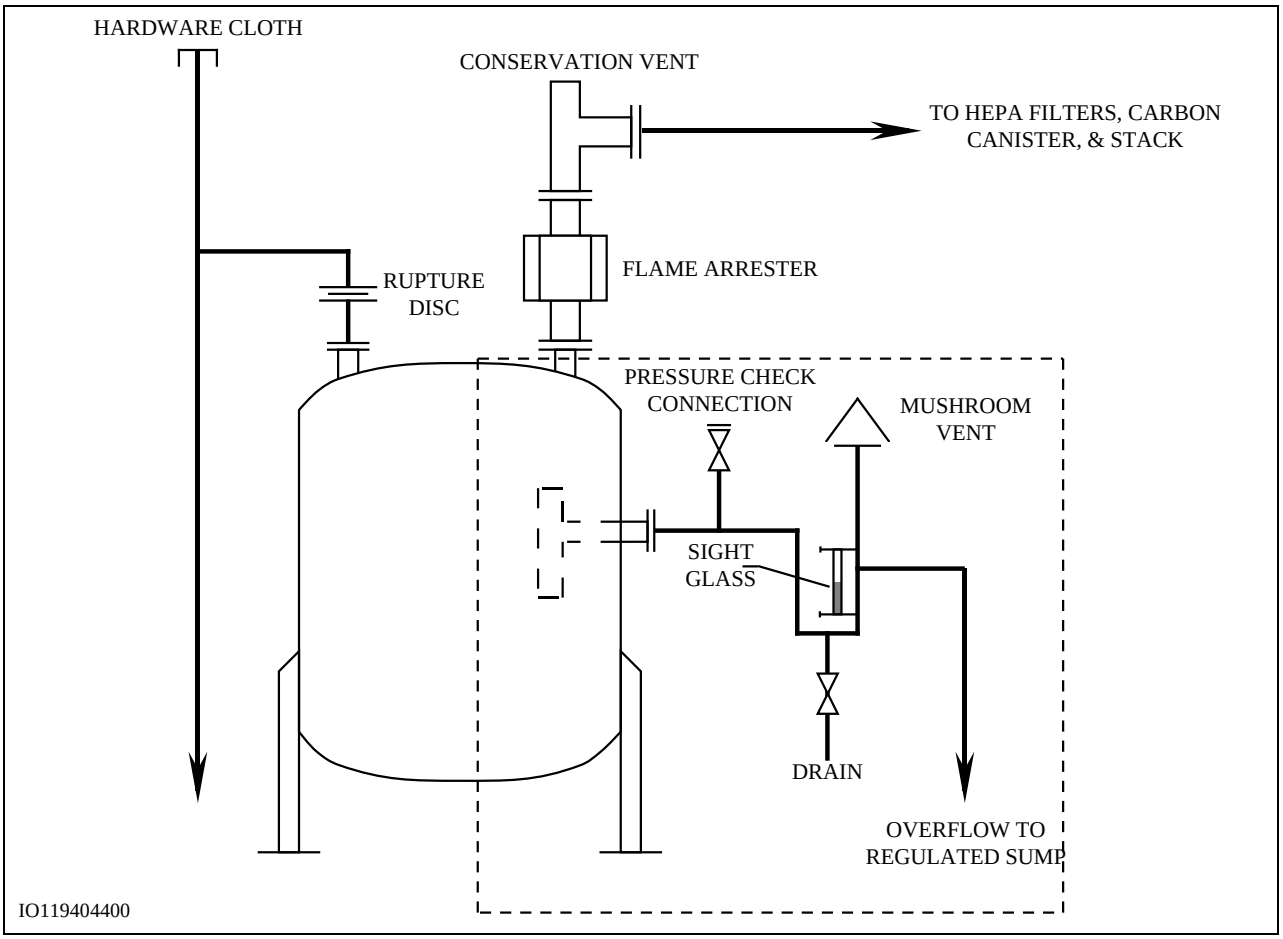


Figure 4 - Waste Tank Loop Seal System

The overflow loop seal is equipped with a sight glass on the outside leg of the seal. Before a tank is purged with nitrogen, and with the inside of the tank at atmospheric pressure, the loop seal should be charged with a thoroughly mixed 50% - 50% solution of water and ethylene glycol. The overflow loop seal is equipped with a mushroom vent on the outside leg. This vent is to assure atmospheric pressure on the outside leg even if the end of the overflow to the sump is under water or liquid waste.

Spare Tank Transfer Pump

The Spare Tank Transfer Pump (P-0608) is located at the tank farm near the Spare Tank (see Figure 3, CIF Tank Farm Layout). It is an ANSI, horizontal, centrifugal pump equipped with a double mechanical seal and a forced circulation barrier fluid system. The pump and motor are mounted on a common drip rim baseplate. A drain line, with a valve, is provided to drain the pump casing. Flanged ball valves are provided for draining the piping and/or flushing the piping with No. 2 fuel oil. The pump is rated at 35 gpm at 58 ft. TDH and driven by a 1.5 hp explosion proof motor.

The principle duty of the transfer pump is to transfer the contents of the Spare Tank to Blend Tanks No. 1 and 2. Provision is also made to discharge to the Aqueous Tank if, on analysis, the contents of the Spare Tank indicate a calorific value of less than 2,200 Btu per pound and the content is compatible with water. A branch line from the pump can circulate a supply through the automatic liquid sampler and back to the tank. A portion of the liquid is extracted and analyzed for viscosity and heating value. Another line, supplied with an orifice, serves as a recirculation line to the tank. This is provided to prevent the pump from discharging against a dead end.

Finally, the pump is provided with a Manual/Auto and Start switch for local operation and a Start/Stop switch for remote operation from the DCS.

Pump Seal System

The Pump Seal System associated with the centrifugal pump is the same for each of the liquid waste centrifugal pumps at the CIF that handle hazardous and/or radioactive wastes. Figure 5, Pump Seal System provides a pictorial representation of the seal system for the pumps. Each of the pumps are equipped with double mechanical seals with a barrier fluid system. The barrier fluid is a 50%-50% mixture of water and ethylene glycol (anti-freeze). The barrier fluid reservoir has a capacity of two gallons. Fluid can be added to the system via a removable cap. A sight glass is provided for a visual check of the barrier fluid. A nitrogen charging valve is installed on the top of the reservoir that will allow the addition of nitrogen into the reservoir.

The reservoir will be pressurized at 21.0 to 31.7 psig (depending on the pump) after the reservoir and barrier fluid pipe lines have been charged with barrier fluid. A pressure gauge will be provided for reading reservoir pressure. A pressure switch is provided to measure pressure in the reservoir. Low pressure will stop the pump which in turn will actuate an alarm in the DCS. A level switch is provided to measure the level of the barrier fluid in the reservoir. Low level will stop the pump which in turn will actuate an alarm in the DCS. Note, that in both cases, it is not the pressure switch or level switch that actuates the alarm in the DCS; but rather, the stopping of the pump.

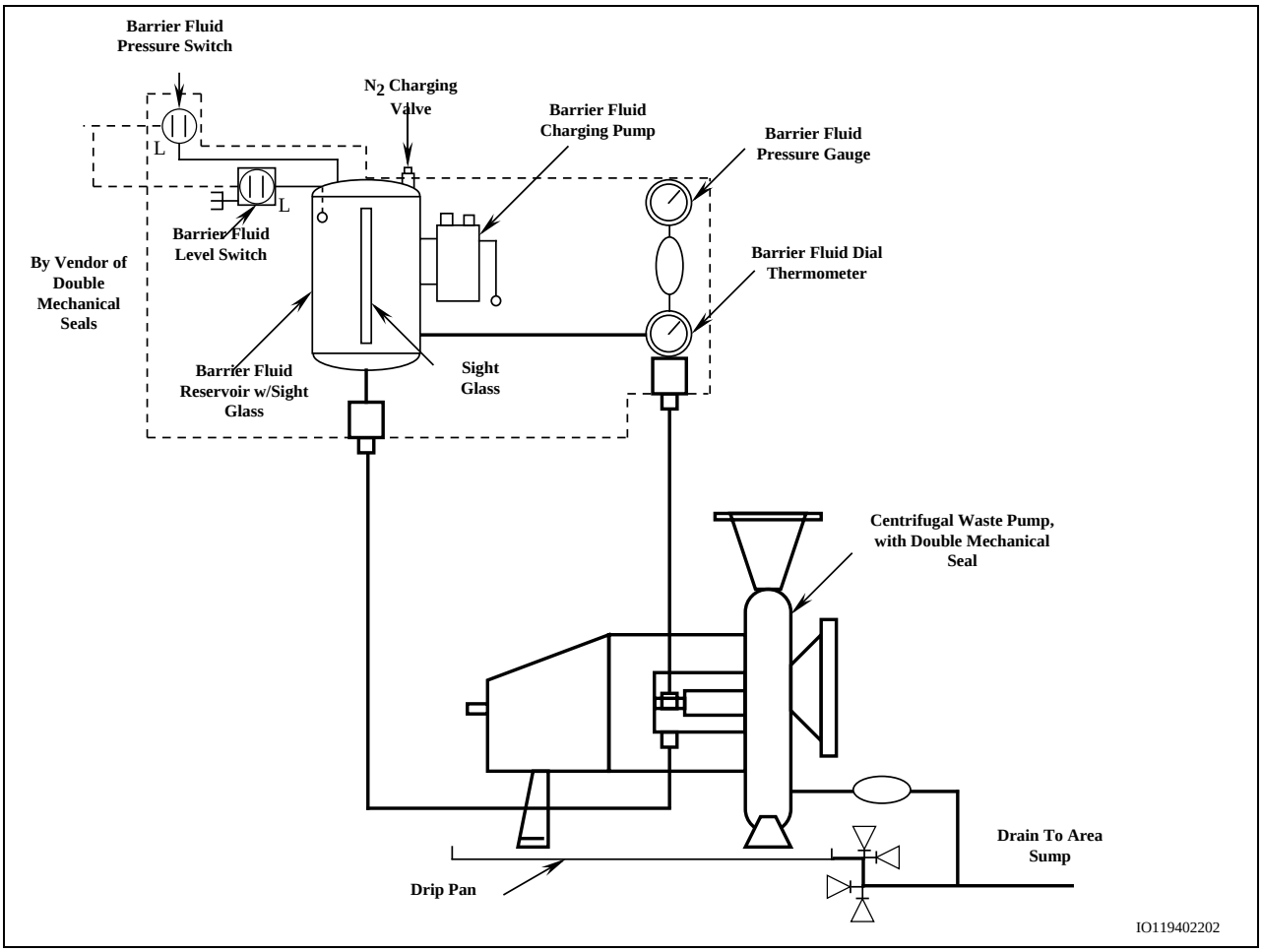


Figure 5 - Pump Seal System

Summary

- The Spare Tank is a carbon steel vessel with a maximum capacity of 6500 gallons.
- The tank is designed for 10 psig positive pressure plus static head and a 2.5 psig negative pressure at 200 °F.
- The tank is electrically heat traced which maintains a temperature of 50 °F for freeze protection.
- Nitrogen is supplied to the tank for purging and for maintaining an inert blanket above the liquid level.
- The Spare Tank serves the purpose of a standby mixing tank and can be supplied with liquid waste from any one of six sources.

- The Spare Tank is equipped with a:
  - flame arrester
  - conservation vent
  - rupture disc
  - Loop Seal System
- The flame arrester prevents the propagation of a flame from outside the stack back into the vent system.
- The conservation vent will not open until the gas pressure in the tank is 8 INWC.
- The rupture disc is designed to break at 1.5 psig positive pressure and to withstand a minimum pressure of 2.50 psig negative pressure.
- The loop seal will withstand 2.38 psig positive pressure before it overflows and will collapse at 2.38 psig negative pressure.
- The principle duty of the transfer pump is to transfer the contents of the Spare Tank to Blend Tanks No. 1 and 2.

INSTRUMENTATION

ELO 3.02	**DESCRIBE the following Spare Tank System instrumentation including indicator location (local or Control Room), sensing points, and associated instrument controls:** **a. Tank Level** **b. Tank Pressure** **c. Tank Temperature** **d. Flow Measurement**

Introduction

The various parameters associated with the Spare Tank System including; Pressure, Level, Temperature, and Density must be monitored to ensure that the operational limits of the system are maintained. With the instrumentation properly calibrated to the specified design setpoints, the resulting signals will enable the operator to maintain normal operations and the resulting alarms and interlocks that occur when a setpoint is exceeded will alert the operator to any possible abnormal situations.

Spare Tank Level & Specific Gravity

Spare Tank level and specific gravity are measured by a bubbler tube arrangement which uses a nitrogen purge. A differential pressure transmitter LT-0601 measures tank level and another differential transmitter DT-0601, is used to measure the specific gravity of the liquid. The transmitters convert the measurements to proportional 4-20mA DC signals which are sent to the DCS. These signals are used to compute a level measurement of the Spare Tank that is compensated according to the density (Specific Gravity) of the material.

These instruments provide level indication, specific gravity indication interlocks and alarms for the DCS. On LOW-LOW level, the specific gravity input to the calculation will be locked on the DCS until it resets on increasing level above LOW-LOW. Level indication is provided with a range of 20-170 INWC and specific gravity indication is provided with a range of 0.6-1.6 spg. The DCS calculates actual tank level by dividing the tank level input by the specific gravity input.

DCS Alarms are provided for the following:

- LOW Level at 48 INWC with a reset at 50 Inches
- LOW-LOW Level at 42 INWC with a reset at 44 Inches
- LOW-LOW-LOW Level at 36 INWC with a reset at 38 Inches.
- HIGH Level at 131 INWC with a reset at 129 Inches
- HIGH-HIGH Level at 137 INWC with a reset at 135 Inches
- HIGH-HIGH-HIGH Level at 138 INWC with a reset at 132 Inches

Spare Tank Temperature

Spare Tank temperature is measured with a Resistance Temperature Detector (RTD) sensor (TE-0605) and transmitter (TE-0605). The RTD provides input to the temperature transmitter which, in turn, provides an output to the DCS. The DCS indication has a range of 40-110°F. Alarms are provided on the DCS for LOW-LOW temperature at 50°F and HIGH-HIGH temperature at 100°F. Additionally, the temperature transmitter provides input to the A050 interlock on a LOW temperature of 60°F or a HIGH temperature 90°F.

Spare Tank Transfer Flow

Spare Tank transfer flow is measured by a Coriolis mass type (FT-0616) flowmeter transmitter and provides an indication. The signal from the flowmeter is sent to the DCS to provide indication with a range of 0-400 lb/min. A flow totalizer (FQ-0616) is provided at the DCS to indicate total flow from the Spare Tank. Additionally, the DCS is provided with a flow switch which allows the operator to adjust the total flow setpoint. The totalizer will provide the input to the Interlock A055 when the HIGH Total Flow setpoint is exceeded.

Corrosion Probes

The Spare Tank is equipped with an electrical resistance probe (AE-0618), which is exposed to the corroding environment in the tank. The corrosion transmitter (AT-0618) converts the corrosion (a function of increasing resistance) to a signal that corresponds to 0 to 5 mils of corrosion. An alarm is provided on the DCS at 4.5 mils with the calculation performed every hour. The corrosion probe has an effective probe life of 5 mils. In addition to the Spare Tank, Blend Tanks 1 & 2 and the Aqueous Waste Tank are equipped with corrosion probes. Corrosion coupons are also inserted in a stack arrangement at various levels in the Spare Tank to simulate actual corrosion of the tank. If a High Corrosion alarm is received, then the corrosion coupons will be pulled and inspected.

Spare Tank Nitrogen Pressure

- HIGH pressure switch (PSH-0604) provides a HIGH Pressure DCS Alarm (H-262-WTE-PAH-0604) at 34.6 INWC.
- LOW pressure switch (PSL-0604) provides a LOW Pressure DCS Alarm (H-262-WTE-PAL-0604) at 0 INWC.

Other DCS Indications

Other DCS indications include the following:

- Spare Tank Pump Run Status (QI-0608)
- Spare Tank Pump DCS Start/Stop [HS-0608-(A)]
- Spare Tank Agitator Run Status (QI-0629)
- Spare Tank Agitator DCS Start/Stop [HS-0629-(A)]
- Spare Tank To Blend Tank 1 valve position indication (ZI-0308-(A) for Closed) & (ZI-0308-(B) for Opened).
- Spare Tank To Blend Tank 2 valve position indication (ZI-0411-(A) for Closed) & (ZI-0411-(B) for Opened).
- Spare Tank to Aqueous Waste Tank valve position indication (ZI-0528-(A) for Closed) & (ZI-0528-(B) for Opened)

Summary

- Spare Tank level and specific gravity are measured by a bubbler tube arrangement and allows DCS indications and alarms.
- Spare Tank temperature is measured with a Resistance Temperature Detector (RTD) sensor and allows DCS indications and alarms.
- Spare Tank transfer flow is measured by a Coriolis mass type flowmeter transmitter and provides an indication.
- A flow totalizer is provided at the DCS to indicate total flow from the Spare Tank.
- The DCS is provided with a flow switch allowing the operator to adjust the total flow setpoint.
- The Spare Tank is equipped with an electrical resistance probe which is exposed to the corroding environment in the tank and allows DCS alarms.
- HIGH and LOW N_2 pressure switches allows DCS alarms.

- Other DCS indications include:
  - Spare Tank Pump DCS Start/Stop and Run Status
  - Spare Tank Agitator DCS Start/Stop and Run Status
  - Spare Tank To Blend Tank 1, Blend Tank 2, and Aqueous Waste Tank valve position indications

CONTROLS, INTERLOCKS AND ALARMS

ELO 3.03	**INTERPRET the following Spare Tank System alarms, including the conditions causing alarm actuation and the basis for the alarms:** **a. HIGH Corrosion** **b. HIGH Level** **c. HIGH-HIGH Level** **d. HIGH-HIGH-HIGH Level** **e. LOW Level** **f. LOW-LOW Level** **g. LOW-LOW-LOW Level** **h. HIGH N2 Pressure** **i. LOW N2 Pressure** **j. HIGH-HIGH Temperature** **k. LOW-LOW Temperature**
ELO 3.04	**EXPLAIN how the following Spare Tank System equipment is controlled in all operating modes or conditions to include control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation:** **a. Spare Tank Transfer Pump** **b. Tank Agitator**
ELO 3.05	**DESCRIBE the interlocks associated with the following Spare Tank System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary:** **a. Spare Tank Transfer Pump** **b. Isolation Valves**
ELO 4.02	**DETERMINE the effects on the Spare Tank System and the integrated plant response when given any of the following:** **a. Indications/alarms** **b. Malfunctions/failure of components**

Controls

Spare Tank Transfer Pump

The Transfer Pump is provided with three switches. A Manual/Off/Auto Switch HS-0608-(B) and a Start Switch HS-0608-(C). Both switches are locally mounted and allow for starting and testing the operational status of the pump. A third Start/Stop switch, HS-0608-(A), is provided on the DCS. Normally , the pump is started locally; but, can be stopped from either location. The DCS is also provided with an indicator (QI-0608) which provides running status of the pump.

Spare Tank Agitator

The Agitator is provided with three switches. A Manual/Off/Auto Switch HS-0629-(B) and a Start Switch HS-0629-(C). Both switches are locally mounted and allow for starting and testing the operational status of the agitator. A third Start/Stop switch, HS-0629-(A), is provided on the DCS. Normally , the agitator is started locally; but, can be stopped from either location. The DCS is also provided with an indicator (QI-0629) which provides running status of the agitator.

Spare Tank Heat Trace

The tank is electrically heat traced to maintain a temperature of 50°F for freeze protection. A Start/Stop switch, HS-0630, is provided on the DCS to control the temperature.

Interlocks and Alarms

CLI Number	Description	Setpoint	Units
H-262-WTE-AAH-0618	HIGH Corrosion Alarm, DCS	4.5	Mils
H-262-WTE-LAH-0601	HIGH Level Alarm, DCS	131	INWC
H-262-WTE-LAHH-0601	HIGH-HIGH Level Alarm, DCS	137	INWC
H-262-WTE-LAHH-0602	HIGH-HIGH-HIGH Level Alarm, DCS	138	INWC
H-262-WTE-LAL-0601	LOW Level Alarm, DCS	48	INWC
H-262-WTE-LALL-0601-(A)	LOW-LOW Level Alarm, DCS	42	INWC
H-262-WTE-LALL-0601-(B)	LOW-LOW-LOW Level Alarm, DCS	36	INWC
H-262-WTE-PAH-0604	HIGH N_2 Pressure Alarm, DCS	34.6	INWC
H-262-WTE-PAL-0604	LOW N_2 Pressure Alarm, DCS	0	INWC
H-262-WTE-TAHH-0605	HIGH-HIGH Temperature Alarm, DCS	100	°F
H-262-WTE-TALL-0605	LOW-LOW Temperature Alarm, DCS	50	°F

Table 1 Spare Tank Alarms and Setpoints

HIGH Corrosion Alarm

If a HIGH Corrosion Alarm is received, per procedure 261-AOP-WTE-01, the tank is to be emptied and flushed to curtail the corrosion. Corrosive materials in the tanks could cause damage to the tank and associated equipment and is therefore undesirable.

Spare Tank to Blend Tank 1 Valve (A021)

Requirements for transfer from the Spare Tank to Blend Tank #1 (Refer to Drawing SE5-2-2006176, CIF Tank Farm Logic Diagram Sheet 2 Instruments):

- Spare Tank Transfer Pump local MOA Station in AUTO
- Spare Tank Selector Switch in BLEND TANK NO. 1 position
- Quantity setpoint on Flow Switch FQ-0616 set to desired value (>0)
- Spare Tank N2 pressure between LOW and HIGH-HIGH
- Spare Tank Level > LOW-LOW-LOW
- Blend Tank #1 N2 pressure between LOW and HIGH-HIGH
- Blend Tank #1 Level < HIGH-HIGH
- Blend Tank #1 Level < HIGH-HIGH-HIGH
- Spare Tank Transfer Pump, Pump Seal N2 pressure > LOW
- Spare Tank Transfer pump Seal Liquid Level > LOW

- The following valves must be closed:
  - HV-0309, Aqueous Waste Valve from Transfer Pump Discharge to Blend Tank #1 closed
  - HV-0311, Blend Tank #1 Discharge valve to Rotary Kiln closed
  - HV-0312, Recirculation Return Valve to Blend Tank #1 closed
  - HV-0307, Rad Oils/Solvents Unloading Pump Discharge to Blend Tank #1 closed
  - HV-0314, Fuel Oil Valve from Transfer pump Discharge to Blend Tank #1 closed
  - HV-0411, Spare Tank Valve to Blend Tank #2 closed
  - HV-0528 Spare Tank Valve to Aqueous Waste Tank closed
- No Combustible gas detected in the following:
  - Tank Farm areas
  - Tank Farm Stack
  - Incinerator Areas

Spare Tank to Blend Tank 2 Valve (A032)

Requirements for transfer from the Spare Tank to Blend Tank #2 (Refer to Drawing SE5-2-2006176, CIF Tank Farm Logic Diagram Sheet 2 Instruments):

- Spare Tank Transfer Pump local MOA Station in AUTO
- Spare Tank Selector Switch in BLEND TANK NO. 2 position
- Quantity setpoint on Flow Switch FQ-0616 set to desired value (>0)
- Spare Tank N2 pressure between LOW and HIGH-HIGH
- Spare Tank Level > LOW-LOW-LOW
- Blend Tank #2 N2 pressure between LOW and HIGH-HIGH.
- Blend Tank #2 Level < HIGH-HIGH
- Blend Tank #2 Level < HIGH-HIGH-HIGH
- Spare Tank Transfer Pump, Pump Seal N2 pressure > LOW
- Spare Tank Transfer pump Seal Liquid Level > LOW
- No Combustible gas detected in the following:
  - Tank Farm areas
  - Tank Farm Stack
  - Incinerator Areas

- The following valves must be closed:
  - HV-0406, Aqueous Waste Valve from Transfer Pump Discharge to Blend Tank #2 closed
  - HV-0408, Blend Tank #2 Discharge valve to Rotary Kiln closed
  - HV-0409, Recirculation Return Valve to Blend Tank #2 closed
  - HV-0410, Rad Oils/Solvents Unloading Pump Discharge to Blend Tank #2 closed
  - HV-0413, Fuel Oil Valve from Transfer pump Discharge to Blend Tank #2 closed
  - HV-0308, Spare Tank Valve to Blend Tank #1 closed
  - HV-0528 Spare Tank Valve to Aqueous Waste Tank closed

Spare Tank Level HIGH-HIGH (A046)

When actuated by Level Switch LS-0601-4, the following will occur (The logic diagrams associated with this input are referenced under each of the components mentioned):

- Spare Tank HIGH-HIGH Level Alarm (LAH-0601) on the DCS will actuate.
- Prevents opening the following valves:
  - HV-0009, Rad Oils/Solvents Unloading Valve to the Spare Tank (Interlock A090)
  - HV-0529, Regulated Sump Valve to Spare Tank (Interlock A093)
  - HV-0530, Aqueous Waste Valve to Spare Tank (Interlock A094)
  - HV-0318, Blend Tank #1 Valve to Spare Tank (Interlock A096)
  - HV-0418, Blend Tank #2 Valve to Spare Tank (Interlock A095)

Spare Tank Level LOW-LOW-LOW (A047)

When actuated, the Spare Tank Level interlock, will result in the following (The logic diagrams associated with this input are referenced under each of the components mentioned):

- Prevents operation of the Spare Tank Agitator (Interlock A091)
- Causes an alarm on the DCS (LALL-0601)
- Prevents operation of the Spare Tank Heat Tracing
- Prevents operation of the Spare Tank Transfer Pump

Spare Tank Level HIGH-HIGH-HIGH (A048)

When actuated by Level Switch LS-0602, the following will occur(The logic diagrams associated with this input are referenced under each of the components mentioned):

- Spare Tank HIGH-HIGH-HIGH Level Alarm (LAHH-0602) on the DCS will actuate

- Prevents opening the following valves:
  - HV-0009, Rad Oils/Solvents Unloading Valve to the Spare Tank (Interlock A090)
  - HV-0529, Regulated Sump Valve to Spare Tank (Interlock A093)
  - HV-0530, Aqueous Waste Valve to Spare Tank (Interlock A094)
  - HV-0318, Blend Tank #1 Valve to Spare Tank (Interlock A096)
  - HV-0418, Blend Tank #2 Valve to Spare Tank (Interlock A095)

Spare Tank Nitrogen Pressure LOW/HIGH (A079)

The Spare Tank Nitrogen Pressure LOW/HIGH interlock provides input to the following on LOW pressure(The logic diagrams associated with this input are referenced under each of the components mentioned):

- Prevent operation of the Spare Tank Heat Trace
- Prevents operation of the following pumps:
  - Spare Tank Transfer Pump (Interlock A049)
  - Rad Oils/Solvents Unloading Pump (Interlock A013)
  - Regulated Sump Pump (Interlock A063)
- Prevents operation of Spare Tank Agitator AGT-0629 (Interlock A091)
- Prevents the following valves from opening:
  - HV-0528, Spare Tank Valve to the Aqueous Waste Tank (Interlock A092)
  - HV-0308, Spare Tank Valve to Blend Tank 1 (Interlock A021)
  - HV-0411, Spare Tank Valve to Blend Tank 2 (Interlock A032)
  - HV-0009, Rad Oils/Solvents Valve to the Spare Tank (Interlock A090)
  - HV-0318, Blend Tank #1 Valve to the Spare Tank (Interlock A096)
  - HV-0418, Blend Tank #2 Valve to the Spare Tank (Interlock A095)
  - HV-0530, Aqueous Waste Tank Valve to the Spare Tank (Interlock A094)
  - HV-0529, Regulated Sump Valve to the Spare Tank (Interlock A093)

Spare Tank Level LOW-LOW (A082)

When Spare Tank Level decreases below the LOW-LOW Level, this interlock locks out the specific gravity input to tank level indication calculation in the DCS.

Spare Tank Nitrogen Pressure HIGH-HIGH (A085)

The Spare Tank Nitrogen Pressure High-High interlock provides input to the following on HIGH-HIGH pressure(The logic diagrams associated with this input are referenced under each of the components mentioned):

- Prevent operation of the Spare Tank Heat Trace
- Prevents operation of the following pumps:
  - Spare Tank Transfer Pump (Interlock A049)
  - Rad Oils/Solvents Unloading Pump (Interlock A013)
  - Regulated Sump Pump (Interlock A063)
- Prevents operation of Spare Tank Agitator AGT-0629 (Interlock A091)
- Prevents the following valves from opening:
  - HV-0528, Spare Tank Valve to the Aqueous Waste Tank (Interlock A092)
  - HV-0308, Spare Tank Valve to Blend Tank 1 (Interlock A021)
  - HV-0411, Spare Tank Valve to Blend Tank 2 (Interlock A032)
  - HV-0009, Rad Oils/Solvents Valve to the Spare Tank (Interlock A090)
  - HV-0318, Blend Tank #1 Valve to the Spare Tank (Interlock A096)
  - HV-0418, Blend Tank #2 Valve to the Spare Tank (Interlock A095)
  - HV-0530, Aqueous Waste Tank Valve to the Spare Tank (Interlock A094)
  - HV-0529, Regulated Sump Valve to the Spare Tank (Interlock A093)

Actuation of the pressure switch associated with this interlock is an indication that the Rupture Disk may be broken. The Rupture Disk is addressed in the Waste Vent System module.

Spare Tank Agitator Permissive (A091)

The Spare Tank Agitator requires the following conditions to operate (Refer to Drawing SE5-2-2006178, CIF Tank Farm Logic Diagram Sheet 4 Instruments):

- Spare Tank Nitrogen Pressure between LOW and HIGH-HIGH
- Spare Tank Level greater than LOW-LOW-LOW

Spare Tank to Aqueous Waste Tank Valve (A092)

Requirements for transfer from the Spare Tank to the Aqueous Waste Tank (Refer to Drawing W2017839, CIF Tank Farm Logic Diagram Sheet 26 Instruments):

- Spare Tank Transfer Pump local MOA Station in AUTO
- Spare Tank Selector Switch in AQUEOUS WASTE TANK position
- Quantity setpoint on Flow Switch FS-0616 set to desired value (>0)
- Spare Tank N2 pressure between LOW and HIGH-HIGH
- Spare Tank Level > LOW-LOW
- Aqueous Waste Tank N2 pressure between LOW and HIGH-HIGH
- Aqueous Waste Tank Level < HIGH-HIGH
- Aqueous Waste Tank Level < HIGH-HIGH-HIGH
- Spare Tank Transfer Pump, Pump Seal N2 pressure > LOW.
- Spare Tank Transfer pump Seal Liquid Level > LOW.
- The following valves must be closed:
  - HV-0309, Aqueous Waste Valve from Transfer Pump Discharge to Blend Tank #1 closed
  - HV-0406, Aqueous Waste Valve from Transfer Pump Discharge to Blend Tank #2 closed
  - HV-0510, Fuel Oil Valve from Transfer pump Discharge to Aqueous Waste Tank closed
  - HV-0308, Spare Tank Valve to Blend Tank #1 closed
  - HV-0411, Spare Tank Valve to Blend Tank #2 closed
  - HV-0522, Regulated Sump to Aqueous Waste Tank Valve closed
  - HV-0511, Sump Pump System to Aqueous Waste Tank Valve closed
  - HV-0523, Clean Sump to Aqueous Waste Tank valve closed
  - HV-0530, Aqueous Waste Tank Valve from Transfer Pump Discharge to Spare Tank closed
- No Combustible gas detected in the following:
  - Tank Farm areas
  - Tank Farm Stack
  - Incinerator Areas

Spare Tank Transfer Pump

The Spare Tank Transfer Pump starting interlock uses the same inputs as the valves that allow pumping the Spare Tank to the Aqueous Waste Tank or one of the Blend Tanks. The basis for the interlock is determined by the position of the Spare Tank Selector Switch position. The inputs are all combined and shown on Drawing W2017839, CIF Tank Farm Logic Diagram Sheet 26 Instruments.

Spare Tank Heat Trace

The Spare Tank Heat Trace is controlled by the DCS. Permissive input is required from the following (Refer to Drawing SE5-2-2006177, CIF Tank Farm Logic Diagram Sheet 3 Instruments):

- Spare Tank Nitrogen Pressure between LOW and HIGH-HIGH
- Spare Tank Level greater than LOW-LOW-LOW

Operation of the Heat Trace is automatic once the START push button (PB-0630-1) on the DCS is pushed. When the temperature of the Spare Tank is below LOW temperature, the heater is energized, when the temperature is above HIGH temperature, the heater is de-energized. Automatic operation of the Heater is stopped by pressing the STOP push button PB-0630-2 on the DCS.

Limits

There are no specific limits associated with the Spare Tank System. The waste permits (Environmental Protection Agency (EPA), Resource Conservation and Reclamation Act (RCRA), and South Carolina Department of Heath and Environmental Control (SCDHEC)) associated with the CIF include limitations on waste transfer and requirements for operation of the facility. Some of these are identified below:

- Before waste is transferred to a tank, its composition will be reviewed to determine the proper waste category, to ensure compatibility with the other materials in the tank, and to determine it the tank will require cleaning to safely handle the waste. (RCRA Application Permit/section D.2.2.2).
- When Spare Tank is in service mode, the tanks will only be filled to 90 percent capacity. (RCRA Application Permit/section D.2.2.2).
- Laboratory compatibility tests will be performed prior to every addition to a tank/container unless the tank/container contains the same material as the waste being added, process knowledge demonstrates the waste being added is compatible with the waste in the tank, or the tank is empty. (RCRA Application Permit/section C.2.6).
- The specific gravity of the liquids stored in the hazardous waste tanks at the CIF will be no greater than 1.15. (RCRA Application Permit/section C.1.2, D.2.2 Table D-5).
- When the Spare Tank is in spare mode, the tank fill limit is as follows:

The Spare Tank should have enough spare tank capacity at any time to accommodate the largest inventory of the waste tanks (Blend Tank #1, Blend Tank #2, Aqueous Waste Tank).

Summary

- The Transfer Pump is provided with three switches:
  - Two switches are locally mounted to allow for starting and testing
  - A Start/Stop switch is provided on the DCS
- The Agitator is provided with three switches:
  - Two switches are locally mounted to allow for starting and testing
  - A Start/Stop switch is provided on the DCS
- A Start/Stop switch for heat tracing is provided on the DCS
- Certain requirements must be met before liquid transfer can be performed.
- Spare Tank level, temperature and nitrogen pressure determine the availability of various equipment.
- No specific limits are associated with the Spare Tank System.
- Composition of waste will be reviewed to determine the proper waste category before transferring to a tank.
- Spare Tank will only be filled to 90 percent capacity when in the service mode.
- Laboratory compatibility tests will be performed prior to every addition to a tank/container.
  - Unless the tank/container contains the same material as the waste being added
- The specific gravity of the liquids stored in the hazardous waste tanks at the CIF will be no greater than 1.15.
- When the Spare Tank is in spare mode, the Spare Tank capacity should equal the largest inventory of the three tank farm waste tanks (Blend Tanks 1 and 2, Aqueous Waste Tank).

Example Problem

Consider the Spare Tank to be at the High alarm level.

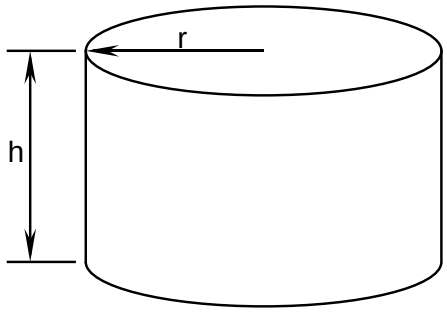
a. Given revision 3 of the setpoint document, what is the level of the tank in inches?

Tank Level = _____ inches

b. With the following dimensions of the spare tank, calculate the approximate volume (gallons) of the fluid at the above alarm.

Tank Dimensions *Diameter* = 10 feet *Height* = 14 feet 6 inches

Volume = **h**eight **π r**adius^2 : $V=h \pi r^2$



height =_____ inches

radius =_____ feet =_____ inches

$\pi = 3.141$

V = _____ = _____ in^3

1 in^3 = 4.329 X 10^{-3} gallons, so

V = _____ gals

c. Calculate the amount of time (minutes) it would take to reset the High alarm using the 35 gpm transfer pump.

Reset at _____ inches

V = _____ = _____ in^3

V = _____ gals

ΔV = _____ = _____ gals

Time = _____ = _____ minutes

SYSTEM INTERRELATIONS

Each of the following systems is addressed in its own module.

DCS

As with most systems associated with the CIF, control of the Spare Tank System is accomplished through the DCS. Pump operation and selection of destination for either pumping or receiving is accomplished using the DCS. Spare Tank operating parameters such as temperature, pressure, and level are all monitored by the DCS. In addition, the spare tank temperature can be maintained above 50 °F by the DCS using the installed heat trace.

Heat Trace System

The Heat Trace System provides freeze protection for the Spare Tank and its associated piping and valves.

Electrical Distribution System

The Electrical Distribution System provides electrical power for the operation of the Spare Tank Transfer Pump and Agitator.

Instrument Air System

The Instrument Air System provides the motive force to operate Spare Tank System Air Operated Valves.

Aqueous Waste System

The Aqueous Waste System can receive waste from the Spare Tank System or send waste to the Spare Tank System.

Blended Waste System

The Blended Waste System can receive waste from the Spare Tank System or send waste to the Spare Tank System.

Tank Farm Automatic Sampler

The Automatic Sampler receives flow from many possible locations, one of which is the Spare Tank System, as indicated on Figure 6, Tank Farm Automatic Sampler. The discharge of the sampler is then returned to the Spare Tank.

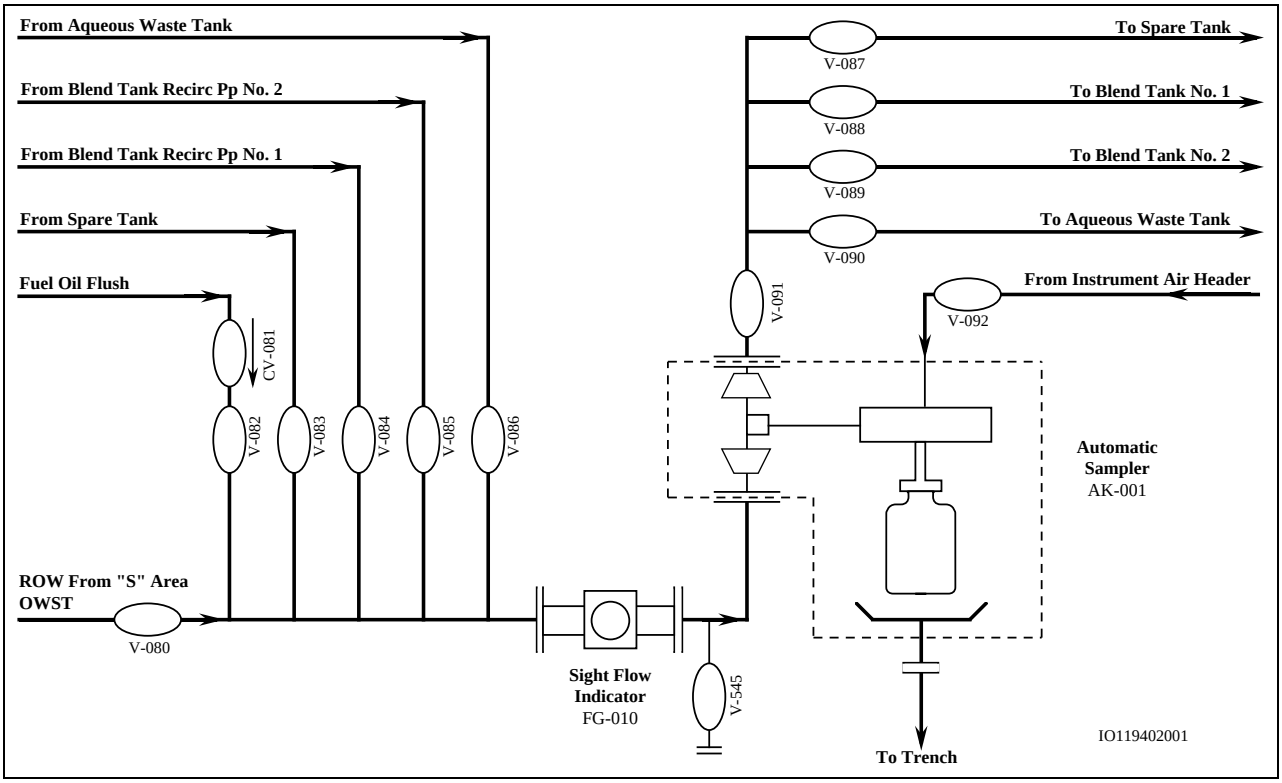


Figure 6 - Tank Farm Automatic Sampler

Nitrogen System

The Nitrogen System supplies an inert blanket above the liquids in the Spare Tank and each of the other three waste tanks. The purpose of the blanket is to prevent the buildup of explosive vapors in the free space above the liquid in the tank. Nitrogen gas at 80 psig is distributed throughout the diked area of the Tank Farm. Pressure reducing valves are used to ensure that the pressure of the inert blanket above the liquid is maintained at 2 INWC pressure.

In addition, the Nitrogen System supplies the purge for the bubbler system used for Spare Tank level measurement. Finally, the Nitrogen System supplies a charging pressure to the reservoir for the Pump Seal System associated with the Spare Tank Transfer Pump to ensure any possible leaks around the pump seals are contained within the system.

Waste Vent System

The Spare Tank is vented to the Waste Vent System. This system directs any gases vented from the Spare Tank through HEPA Filters and a Carbon Canister prior to elevated release via the Tank Farm Stack.

Waste Drains System

The Spare Tank can receive liquid from the Waste Drains System. The Waste Drains System consists of the sumps located throughout the CIF. In addition, the Waste Drains System would contain any leaks associated with the Spare Tank System.

Summary

- Control of the Spare Tank System is accomplished through the DCS.
- Heat Trace System provides freeze protection.
- Electrical Distribution System provides electrical power.
- Instrument Air System provides the motive force for Air Operated Valves.
- The Aqueous Waste System and the Blended Waste System can receive/send waste from/to the Spare Tank System.
- The Automatic Sampler can receive flow from the Spare Tank System and the discharge of the sampler is then returned to the Spare Tank.
- The Nitrogen System supplies:
  - inert blanket above the liquids to prevent the buildup of explosive vapors
  - a purge to the tank prior to admitting waste
  - the purge for the bubbler system used for Spare Tank level measurement
  - a charging pressure to the reservoir for the Pump Seal System associated with the Spare Tank Transfer Pump
- The Waste Vent System directs any gases vented through HEPA Filters and a Carbon Canister prior to elevated release via the Tank Farm Stack.
- The Spare Tank can receive liquid from the Waste Drains System and the Waste Drains System would contain any leaks associated with the Spare Tank System.

INTEGRATED PLANT OPERATIONS

Introduction

The Spare Tank System is operated per procedure SOP-WTE-02 R, Spare Tank Operations. Entry to this procedure may be directed from General Operating Procedures (GOPs), Alarm Response Procedures (ARPs), Abnormal Operating Procedures (AOPs), or Emergency Operating Procedures (EOPs).

ELO 2.02	**Given a description of the Spare Tank System equipment status, IDENTIFY conditions which interfere with normal system flowpaths.**
ELO 4.01	**Given applicable procedures and plant conditions, DETERMINE the actions necessary to perform the following Spare Tank System operations:** **a. Startup** **b. Manual Operation of Equipment** **c. Shutdown**

Normal Operations

System Startup

The Spare Tanks System is an installed spare system, therefore it is not normally operated. Operations involving the Spare Tanks System will be performed in "Batch" operations, meaning that the system would be aligned and waste either pumped to the tank, or from the tank. It is not intended that the Spare Tank System be operated continuously, although, there are no design reasons to prevent this if it were to be required.

Prerequisites to operating the Spare Tank System include the following:

- SOP-WV-01, Waste Vent, has been performed and a charcoal filter (carbon canister) is in service. This is a regulatory requirement.
- Waste Tank Lines Electric Heat Trace System are in service.
- Explosive gas detectors are not in alarm (another regulatory requirement).
- SOP-WTE-001, Tank Farm Operations, has been performed and the Tank Farm Sumps are in service.
- SOP-LN-01, Liquid Nitrogen Supply, has been performed and nitrogen purge to the Spare Tanks is in service.

After the prerequisites have all been met, the system is aligned in accordance with the SOP.

Spare Tank and Transfer Pump Operation

The Spare Tank, as are all waste tanks, is interlocked to prevent receiving waste into and pumping waste out of the tank simultaneously. Upon completion of a transfer into the Spare Tank, Spare Tank level is verified to be (LATER) on the DCS and nitrogen blanket pressure is verified at 2 INWC. Pre-start Operational Checklist (LATER) is performed on the Spare Tank Transfer Pump.

The amount of time for recirculation is obtained from the SS (a minimum of 10 minutes of recirculation is required prior to sampling the Spare Tank) and recorded in the SOP. The Spare Tank Agitator and Transfer Pump local MOA switches are placed in AUTO and the agitator and pump are started. After the required recirculation time has elapsed, the SS shall be notified to request a sample of the Spare Tank from the Chemistry Coordinator (CC). The operator will assist the CC in valving to obtain a sample of the Spare Tank.

Transfer of Waste from the Spare Tank

As mentioned previously, Waste can be transferred from the Spare Tank to either of the Blend Tanks or to the Aqueous Waste Tank. The level in the target tank is recorded in the SOP to ensure that there is and adequate free volume to receive the contents of the Spare Tank. The SS must authorize by signature any transfers. In addition, the SS will provide the Spare Tank level at which to terminate the transfer. The next step is to verify, with the CC, that the Spare Tank sample results and the target tank sample results are acceptable for the transfer. This is a critical step in that the contents of the two tanks must be compatible to ensure that no adverse reactions occur. If the contents of the tanks are not compatible, it is possible for an exothermic reaction to occur which could result in overheating, fire, or an explosion.

After the CC has verified by signature that the contents of the Spare Tank and the target tank are compatible the system is aligned to transfer the waste and pump is started. The desired total flow is obtained from the SS and using the DCS, flow is established to the target tank. Another important step to verify proper operation of the system is to ensure that an increasing level is observed in the target tank. This indicates that the system is properly aligned. If an increasing level is not observed, it is an indication of improper lineup, or possibly even a leak. When the Spare Tank Level reaches the predetermined point, stop the transfer and realign the system in accordance with the SOP.

ELO 2.03	**Given a description of abnormal equipment status for the Spare Tank System, EXPLAIN the significance of the condition on system operation.**

Abnormal Operations

Component failure in any of the following, could indicate a problem in the Spare Tank or Tank Farm in general, and would result in initiation of AOP-WTE-01:

- Pump / Valve Seals
- Pump / Valve Failure
- Nitrogen Blanketing System
- Tank Vent System
- Loop Seal System
- Liquid Sampling System
- Fire Suppression System
- Loss of Instrumentation
- Rupture Disk Alarm
- LOW / HIGH Tank Level Alarms or Switches
- LOW / HIGH Tank Temperature Alarms or Switches
- LOW / HIGH Tank Pressure System
- N2 Tank LOW Level Alarm
- N2 Tank LOW / HIGH Pressure Alarm
- Constant Air Monitors
- Sump Pump Operational Failure
- Unloading Line Filters
- Tank Heater System
- Tank Agitator
- LOW / HIGH Tank Level System
- LOW / HIGH Tank Pressure System
- HEPA Filter System
- Rupture Disk System
- Loss of Main Nitrogen
- Explosive Gas Detectors in Alarm
- Piping Heat Tracing Malfunction
- Corrosion Detector Alarm
- HIGH Tank Temperature NOT caused by Tank Heater System Failure (Signifying Possible Exothermic Chemical Reaction).

Individual tanks or the entire Tank Farm may shutdown depending on the failure that occurs.

Infrequent Operations

System Flushes

Occasionally it may be necessary to perform a system flush of the Spare Tank System to eliminate localized hot spots or for other reasons determined by the SS. These flushes are normally performed using fuel oil. The Spare Tank System is provided with 1-inch flanged ball valves throughout the system to make connections with the oil flushing line. The fuel Oil Transfer Pump provides the necessary head to flush the lines.

Summary

- The Spare Tank System is operated per procedure SOP-WTE-02 R.
- The Spare Tanks System is an installed spare system, therefore it is not normally operated.
- The Spare Tank System is not intended to be operated continuously, although, there are no design reasons to prevent this if it were to be required.
- Prerequisites to operating the Spare Tank System include:
  - SOP-WV-01, Waste Vent, has been performed and a charcoal filter (carbon canister) is in service
  - Waste Tank Lines Electric Heat Trace System are in service
  - Explosive gas detectors are not in alarm
  - SOP-WTE-001, Tank Farm Operations, has been performed and the Tank Farm Sumps are in service
  - SOP-LN-01, Liquid Nitrogen Supply, has been performed and nitrogen purge to the Spare Tanks is in service
- Spare Tank sample results and the target tank sample results must be acceptable for a liquid transfer. If the contents of the tanks are not compatible, it is possible for an exothermic reaction to occur which could result in overheating, fire, or an explosion.
- Individual tanks or the entire Tank Farm may shutdown depending on the component failure that occurs.
- A system flush of the Spare Tank System may be necessary to eliminate localized hot spots or for other reasons.
- The Fuel Oil System provides the means for performing a system flush.